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## SEPARATION OF THE LOWER FEMORAL EPIPHYSIS.

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IT is customary to look on fractures or separation of epiphyses as equivalent to fractures near a joint, from which, in many cases, they are almost indistinguishable, and to treat them as such. In some situations this may be quite correct from a practical point of view, but in separation of the lower epiphysis of the femur with displacement, such a view would be disastrous in the extreme, and one cannot help being surprised that surgical authors, as shown by the text-books, do not lay more stress on the subject.

Let me give illustrations from one of the most recent works on fractures and dislocations, and from one of the most recent text-books on surgery :

“This (separation of the lower epiphysis of the femur) is not a very uncommon accident, occurring in young persons under the age of nineteen or twenty. In some of these cases there is an ordinary separation of the epiphysis, the fracture passing more or less entirely through the line of junction of the epiphysial cartilage ; in others there is a mixture of fracture with disjunction of the epiphysis. In these injuries the symptoms are much the same as those of transverse fracture of the lower end of the femur, and the possibility of this lesion having taken place must be borne in mind in dealing with injuries of this part in young persons. The treatment consists in putting up the limb on a double inclined plane, in order to relax the muscles which act upon the fragments, and treating the case as an ordinary fracture.”

Again :

“Separation of the lower epiphysis of the femur is not an uncommon accident in children. The wide surfaces are seldom completely separated, and the nature of the injury is further obscured by effusion into the joint ; but it can usually be recognized by seizing the shaft of the femur in one hand and the knee in the other, when lateral movement will be recognized, accompanied by the soft crepitus characteristic of a separated epiphysis. The treatment consists simply in supporting the limb for a few days on a back splint, till the swelling has subsided, when a starched bandage or plaster-of-Paris splint may be applied. Union usually takes place by bone, and is followed by some shortening from interference with growth.”

Could anything be more unfortunate than for a surgeon to follow the advice here set forth in treating such an example as Case I, hereafter to be described? So far as I can ascertain, this fault of omission pervades the standard works on surgery, and it is, therefore, unnecessary to quote further examples. Fortunately, however, for him who has the time to search the journals, there is ample information on the subject, as there have been at least sixty cases recorded in English, American, French and German journals. To confine my references solely to my distinguished predecessors or to my colleagues on the staff of the Leeds Infirmary, I find papers by Hey, in 1869 ; Wheelhouse, 1869 ; Atkinson, 1883 ; Wheelhouse, 1884, and McGill, 1884. In 1883 I myself published a paper in the *Liverpool Medico-Chirurgical Journal*, pointing out the importance of the accident, and illustrating my remarks by specimens in the Museum of the Leeds School of Medicine. Since that time I have had three cases under my care ; in two there was displacement of the epiphysis forward, as shown in Fig. 1 ; in the third the displacement was incomplete, as shown in Fig. 2. I have seen at least three other cases, and in them all the dislocation was forward. I have never seen the displacement shown in Fig. 4, taken from Mr. Hutchinson's Archives, except in fracture just above the epiphysis.

CASE I.—*Separation of Lower Femoral Epiphysis, with Displace-*

*ment Upon the Front of the Femur.* (Abstracted from notes furnished by Mr. E. H. Batchelor.)

John William M., aged fifteen, was admitted to the Leeds General Infirmary, December 11, 1891. On the morning of admission the patient was struck over the lower part of the left thigh by a metal roller six feet long and five inches in diameter, weighing several stone; he at once lost all use of the limb. On admission a few hours later there was very great swelling of the left knee, with

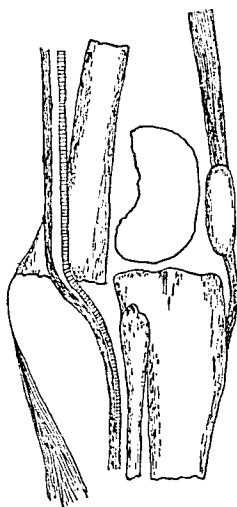


FIG. 1.—Complete forward displacement of lower femoral epiphysis.



FIG. 2.—Incomplete displacement of lower femoral epiphysis.

evident displacement forward of the lower extremity of the femur, and projecting backward into the popliteal space of the lower end of the upper fragment. The lower segment could be felt riding altogether in front of the upper portion, with its flat surface applied to the front of the lower end of the femur. The lower end of the upper fragment evidently compressed the vessels and arrested the circulation in the leg, which was livid, cold and swollen. There was an inch and a half of shortening. The head of the tibia and the patella were

carried forward with the condyles of the femur. No crepitus was obtainable.

Ether having been administered, and the limb fully flexed, one of my dressers locked his hands behind the femur and exerted traction upward, and another grasping the foot drew the leg downward. I was then able to manipulate the epiphysis, which slipped into position with a distinct sound. The length of the limb was then found to be normal, and the circulation was immediately resumed in the leg and foot. The limb was put up in a suspended Macintyre's splint. January 18, 1892, the limb was taken off the splint and the bone found to be in very good position and firmly united. Plaster-of-Paris was applied to fix the joint. January 19, made an outpatient. The plaster was removed at the end of three weeks, when gentle massage was employed. January 29, 1892, he walked to the infirmary, and there was neither deformity, shortening nor impairment of use in the limb. May 5, 1893, patient shown at the Leeds and W. R. Medical Society, when no sign of the injury could be made out.

CASE II.—*Separation of Lower Femoral Epiphysis, with Displacement Laterally and Forward.*

J. C., aged fourteen, while at the Ida Convalescent Home recovering from a severe compound fracture of the right leg, for which a splint was still being worn, fell, September 6, 1888, while getting about on crutches, with the left leg under the splint of the right. Something in the neighborhood of the left knee was felt by the patient to have given way. When seen he was sitting on the ground, pale and complaining of intense pain in the left knee. The left thigh was flexed on the abdomen, and the leg flexed on the thigh, the whole limb being rotated outward. On measuring from the anterior superior spine of the left ilium to the lower border of the patella, there was found to be slight lengthening on the left side. There was considerable swelling of the joint, and immediately above the upper border of the patella there was a depression. No fracture of the shaft of the femur was made out. The relation of the femoral condyles to the head of the tibia were found to be normal, but the whole joint could be moved much more than normally laterally, and especially outward. This movement was accompanied by a soft cracking sound. The limb was straightened and placed on a back splint, lead lotion being applied to the knee, which was much swollen. September 7, no pain; knee still swollen. September 8, seen by Mr. Littlewood; at that time R. S. O. at the infirmary;

examined under ether; half an inch of lengthening; knee swollen; distinct soft crepitus felt, and extensive lateral displacement just above knee joint. Separation of lower epiphysis of femur, with lateral displacement diagnosed.

Reduction effected and limb placed on back splint. Sent in ambulance to the infirmary September 15, where I saw the case. Limb has been kept on back splint. There is still a good deal of effusion into the knee joint, but this is decreasing under the use of evaporating lotions. Back splint reapplied.

September 25, back splint removed; very little swelling; put up in plaster from ankle to groin. September 27, quite comfortable. Made out-patient. October 20, plaster removed and massage advised. December 15, attended as an out-patient, walking well, without deformity. Patient shown at a meeting of the Leeds and W. R. Medico-Chirurgical Society, May 5, 1893, when no sign of the injury could be discovered.

The notes of a third case have been mislaid, so that I cannot give exact details, but it resembles Case I, and was reduced successfully, a useful limb resulting.

REMARKS.—In nearly all the recorded cases extreme direct violence has been the cause.

The direction of the displacement probably partly depends on the direction in which the violence has been applied, but also on the attachment or otherwise of the gastrocnemius tendon to the lower end of the upper fragment. The diagnosis of such an extensive injury might be thought to be devoid of any difficulty, and in the greater number of cases this cannot be considerable, since the shortening of from one to two inches, the projection of the lower end of the diaphysis in the popliteal space, the displacement of the epiphysis on to the front of the femur, and the interference with the circulation in the leg, when taken together with the cause of the injury and the age of the patient, form a group of symptoms pathognomonic of this form of fracture.

The prognosis would seem to be extremely serious, if we may judge from the reported cases, in many of which amputation had to be performed. The dangers, besides the usual ones consequent on so severe an injury, arise from the pressure of the

lower end of the fractured shaft on the popliteal vessels, interfering seriously with the circulation in the leg, and either producing great œdema or gangrene, or leading to secondary hæmorrhage. As regards treatment, reduction under an anæsthetic would seem to be the plan to try at first, and in case of difficulty reduction might be facilitated by the division of the tendo-Achilles; after reduction, either the long splint, with weight and pulley, or the double inclined plane might be employed. Should reduction be impossible, then excision might be adopted; but if the large vessels be ruptured, or gangrene occur, amputation can be the only resource.

The following cases, with their accompanying diagrams, serve to illustrate different varieties of the accident, each case having required amputation, the illustrations being taken after dissection of the amputated limb.

The specimens are at present in the Pathological Museum attached to the Leeds Medical School.

CASE IV.—The history of this case, which was under the care of Mr. Wheelhouse in the Leeds General Infirmary, is as follows: A. B., aged fifteen, had his leg crushed in a colliery accident. The circulation in the injured member was impeded from the first, and on the forty-third day amputation was performed for gangrene. The drawing (Fig. 3) serves to illustrate the condition.

The specimen, which is now preserved in the museum at the Leeds School of Medicine, shows the lower end of the diaphysis projecting into the popliteal space, and tightly stretching the large vessels and nerve; whereas the detached epiphysis is seen lying with its fractured surface on the front of the femur, its articular surface being directed forward, its anterior margin upward, and its posterior downward. The gastrocnemius is attached to the diaphysis.

CASE V.—Under the care of Mr. T. Hay. F. C., aged six, was run over by a cab, and brought to the Infirmary, where it was found that compound diastasis of the lower epiphysis of the femur had occurred, with severe laceration of the soft parts. The lower end of the diaphysis projected through a wound in the popliteal space, while the epiphysis was displaced forward. Primary amputation of the thigh was performed with a good result.

The accompanying drawings show the front and side view of the diastasis, which is preserved in the school museum.

Fig. 4 shows a clean and complete detachment of the lower

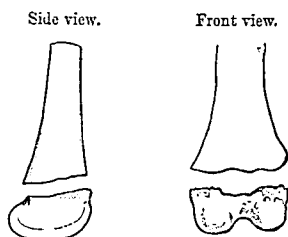


FIG. 3.—Separation of lower epiphysis of femur with forward displacement.

epiphysis of the femur. The muscles of the leg have been dissected in order to show the relation of those of the calf to the epiphysis itself. The lower half of the femur has been cleaved, in order better



FIG. 4.—Separation of lower epiphysis of femur.<sup>1</sup>

to exhibit the form of its epiphysal end. The specimen was obtained by a primary amputation in the case of a boy, aged fourteen, under Mr. Hutchinson's care some years ago in the London Hospital.

<sup>1</sup> From Mr. Hutchinson's Archives of Surgery for January, 1893, p. 287.